Wax

ARPA Network Information Center
Stanford Research Institute
Menlo Park, California 94025

NIC #30796
Packet Radio Temporary Note #108

Network Analysis Corp.
May, 1974

INTERACTIVE/BATCH PACKET RADIO SIMULATOR

I. INTRODUCTION

The Packet Radio System is a broadcast data network extending a point-to-point communication system (such as ARPANET) to provide local collection and distribution of data over large geographical areas. Since the system is wireless, it will be especially effective for mobile devices, devices for which the peak data rate requirements are much higher than average requirements, and devices for which hardwire connections are not feasible.

The system simulated contains three types of communication devices, a terminal, a repeater, and a station. The station is considered as an interface communication device of the broadcast network to a higher level network or to a computer installation. Terminals are considered as traffic sources and traffic sinks, they transmit packets to the station. The basic function of the repeater is to extend the effective range of the terminals and the station. The network simulated contains repeaters and stations which are placed at fixed locations chosen at random. Terminals originate at random times and are placed in random locations on the plane. A terminal departs from the system once it completes its communication.

II. ORGANIZATION

The interactive version of the Packet Radio Simulator runs on two computers:

A. A DEC-10 Tenex machine, and

B. The IBM 360/91 at UCLA-CCN.

It consists of three programs:

1. An interactive Fortran program on the DEC-10 computer. This program produces the coding for an OS job corresponding to the batch part of the Packet Radio Simulator. The file containing the OS job is sent on the ARPANET through the Tenex subsystem RJS to the IBM 360/91. The program is named INPR.SAV;1 A carriage return is inserted at the end of each line before using RJS. This is done with a file named CRFIX.SAV;1.

2. A large simulation program (the source statement contains more than 3,000 image cards and has 33 subroutines) is executed and produces an output file which returns to the Network Virtual Terminal from which (through RJS) the job was submitted. The user fetches the output file through RJS.

3. A TECO program on the DEC-10 computer which received as input, the output file and edits it. The current editing produces a summary of results which occury a single screen on an IMLAC PDS-ID. In addition, the user can scan (using TECO) the complete output file and obtain other statistics not included in the original screenfull or information related to packet flow in the network. To use the program, the user types @ SIMTECO.SAV;1.

III. THE INTERACTIVE DATA ENTRY PROGRAM FOR THE PACKET RADIO SIMULATOR

INTRODUCTION

This program is on a PDP-10 machine with a F40 FORTRAN Compiler. It is divided into two parts:

1. The first part requests the user to enter data (together with a corresponding keyword). The keywords (for now seven in total) with their default values and their meanings appear beforehand on the screen. The user changes the default values associated to the keywords if he so desires. The program performs editing of items as soon as entered. When all the items have been entered, it performs some validity checks allowing the user to correct any errors found.

2. The second part of the program selects which one of two data files (each one containing a complete IBM OS job) has to be modified and thereafter submitted to an IBM machine. One of these two datafiles contains the hierarchical labels in the case of low repeater range (Figure 1), while the other data file contains the hierarchical labels for repeaters in the case of high repeater range (Figure 2). The program overrides some data fields with the answers of the user, using direct access techniques. Then, it indicates the name of the data file to submit to OS.

In the following, we describe in more detail Part 1, Part 2, and the nature of the variables which are entered and modified.

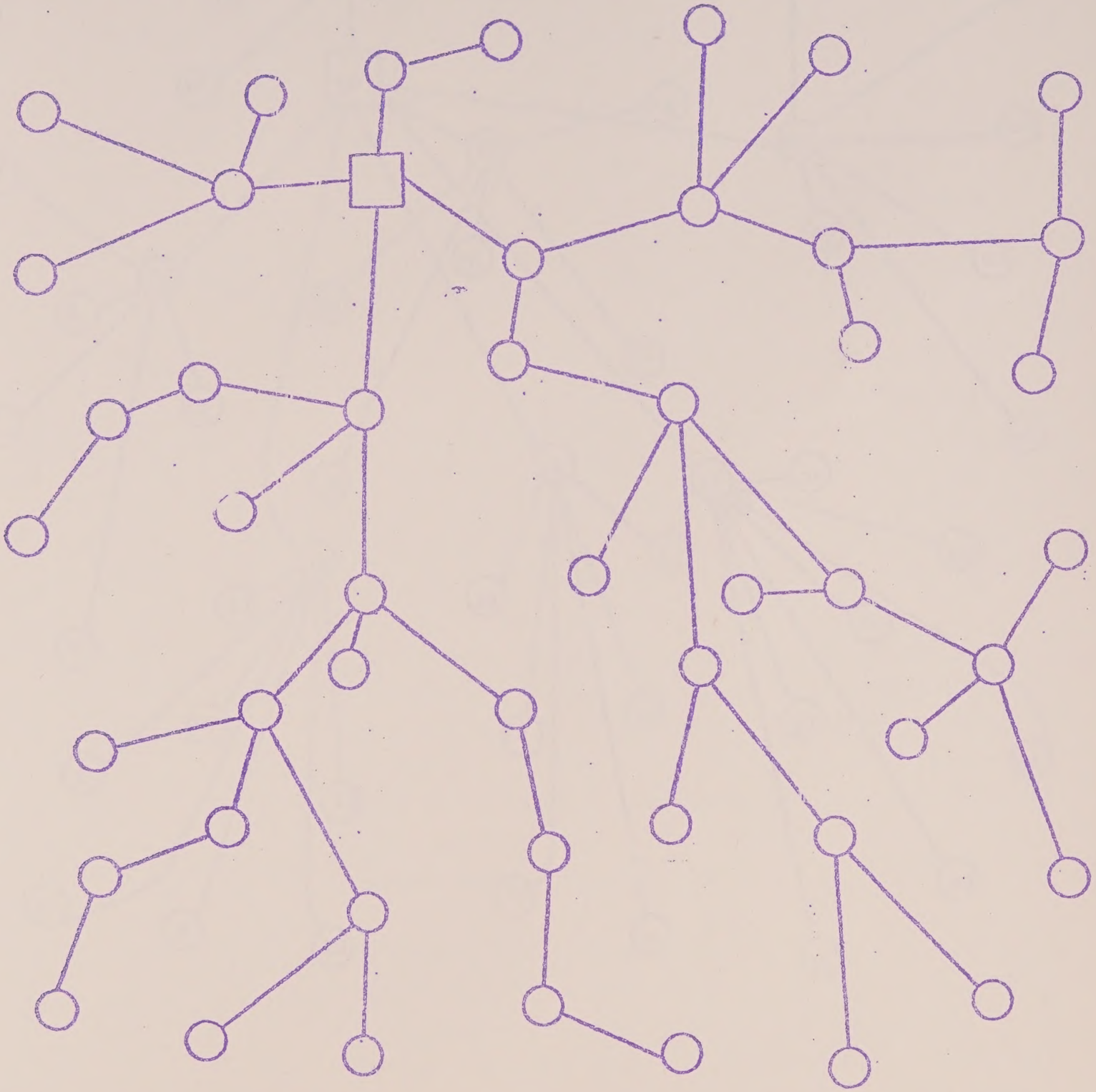


FIGURE 1

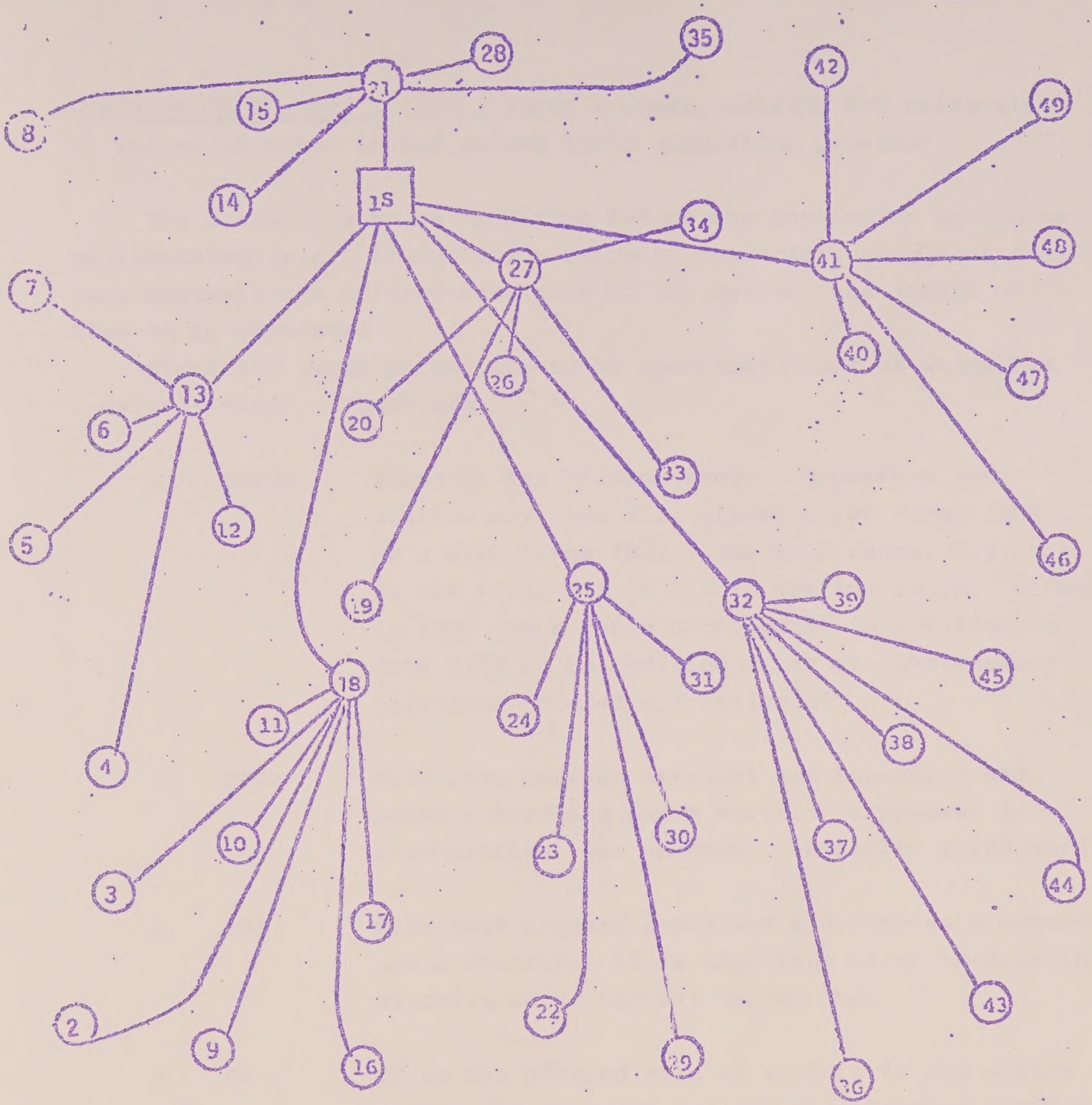
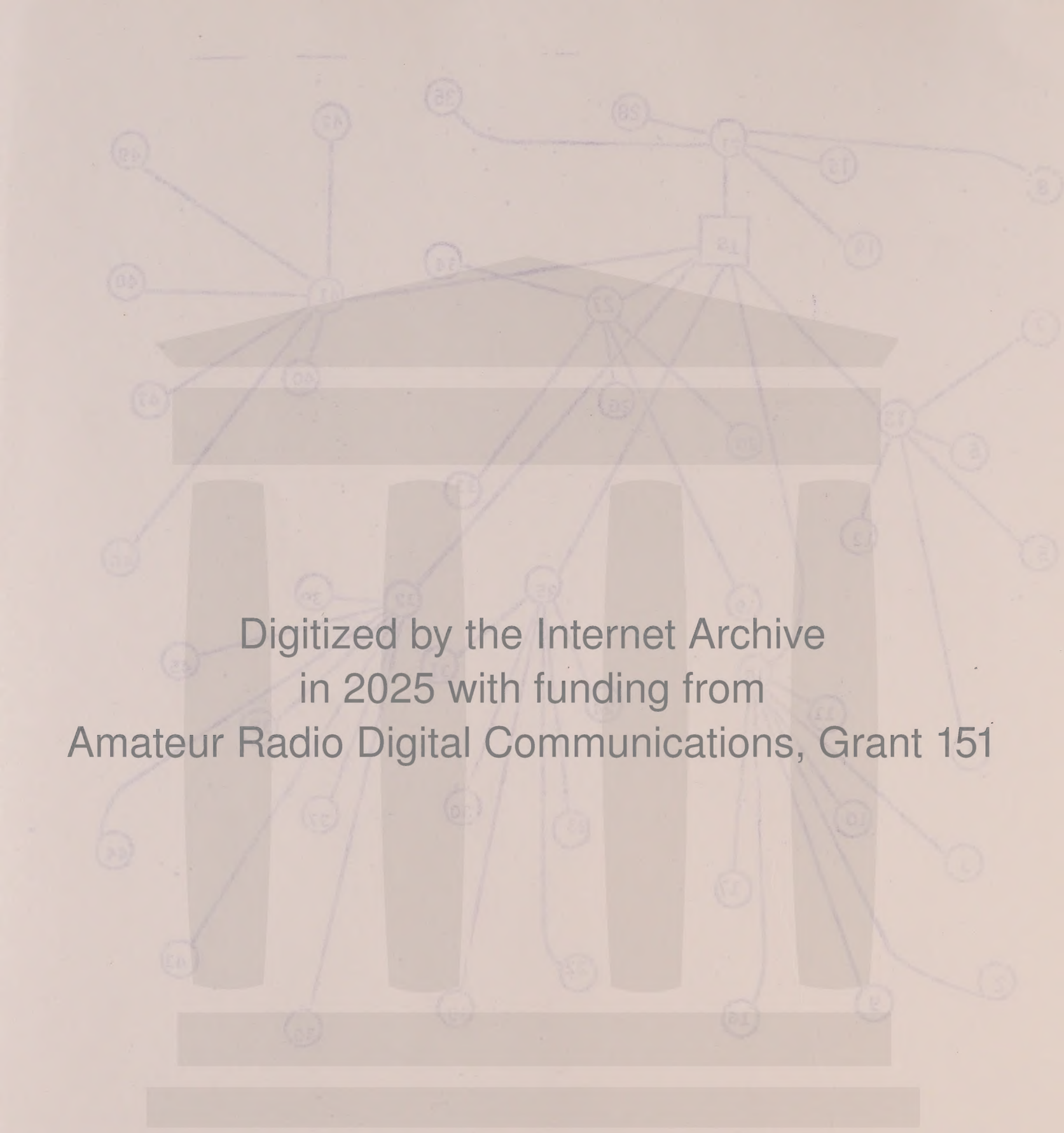

8
15
21
28
35
14
18
34
42
49
41
48
27
7
40
47
13
26
6
20
33
5
12
46
19
25
32
39
45
31
18
24
11
38
4
10
23
30
37
44
3
17
43
2
22
9
29
16
36

FIGURE 2



Digitized by the Internet Archive
in 2025 with funding from
Amateur Radio Digital Communications, Grant 151

https://archive.org/details/temporary-note-108

DESCRIPTION OF PART 1 (i.e., input process, editing and calculation of values to enter in the packet radio simulation program)

The parameters to be specified define the particular system to be simulated (e.g., transmission range of repeaters, single or dual rate system), the offered data rate to the system, and length of time to be simulated

There are seven parameters to be specified, each of which has a default value. These are:

1. RANGE: Repeater and station range. Repeaters and station may have all, either a low range (LOW) or a high range (HI). The high range, e.g., is in the ratio 3.5 to 1.5 to the low range. Default is low. Each range corresponds to a different data file to be modified after all the answers have been entered and validated.

2. DTR: Data rate between terminal and repeaters and between terminal and a station, expressed in kilobits/sec. (an integer). Default is 100 Kb/s.

3. DRR: Data rate between repeaters and between a repeater and a station. It is expressed as an integer in kilobits/sec. Default is 500 Kb/s.

4. OF: OF is the offered rate of traffic to the entire system (it does not include the overhead traffic). It is given as a fraction of the data rate of the channel between terminal and repeater (e.g., if the channel capacity is 100 Kb/s, and the packet

length if 1000 bits, and the offered rate is .06, then

$$(.06)(100,000)/1000 = 6$$

packets of information per second arrive to the system on the average. The default value has been chosen as 0.06.

5. NBITP: Number of bits in a packet (including the header). Default value is 1000.

6. NBITH: Number of bits in a header. Default value is 100.

7. TERM: Number of terminals appearing in the micro-simulation. Default value is 30. This variable is strongly correlated to the cost of running the program and the user should first run the micro-simulation with a low value of TERM in order to appreciate the cost of his simulation. A parameter in the simulation permits at most 200,000 events before printing the summary statistics. Should it be found that a terminal requires in average, 1000 events to be processed, this would place a maximum of 200 to the number of terminals which may enter the network during a simulation run. Remark: An event corresponds to a call to a subroutine. 1000 events may cost up to $.75.

The first part of the program is centered around a call to the subroutine KEYWRD (used to prompt the answers).

Should help be requested, the appropriate information corresponding to the keyword will be printed and the user prompted to enter a keyword and its associated value.

Each time a value is entered, it is edited:

A. The variable RANGE (an integer) may have only the values (alphanumeric constants): LOW or HI.

B. The variable OF (offered rate) should be between 0.00 and .25.

C. A warning is printed if TERM (number of terminals) is greater than 200.

Once all data have been entered, some validity checks are made:

A. We check if DRR is an integer multiple of DTR (which the packet radio simulation program assumes). If it is not the case, the user may return to change the value of DRR and DTR or agrees that the ratio of the two data rates $\frac{DRR}{DTR}$ (default value if 5) is changed into the integer part of $\frac{DRR}{DTR}$.

B. We check that the number of bits in the header is less than or equal to the number of bits in the packet.

If any errors are found, the user is allowed to currect any or all of the parameters.

After the validity checks have been successfully passed, we enter the second part of the parogram which edits the input file for the simulator running on the 360/91.

DESCRIPTION OF PART 2 (selection of a data file containing an OS job and overriding some of its data fields)

Depending on the value (either high or low) entered for the variable RANGE, we define as an input file to the interactive data entry, program one of the two files PR3LB-DAT;1 or PR7LB-DAT;1. The file PR3LB-DAT;1 contains an OS job with labels which form 3 levels (Figure 2) while the file PR7LB-DAT;1 contains a complete OS job for the simulator with labels which form 7 hierarchical levels. The number of hierarchical levels indicates the maximum number of hops that a packet travels when using the "shortest path" routing. The file which is selected is read and written on an output file called PCKRA.DAT with the fields corresponding to values entered during the interactive phase of the program containing these new values. The program then requests the user to enter the TENEX subsystem RJS and to send the file with, in it, the new OS job to the IBM 360/91 by typing:

S PCKRA.DAT (escape)

Before being sent by RJS to the 360/91, the file PCKRA.DAT is entered as input file to the TECO program CRFIX.SAV which insert carriage returns after each line. The user types;

@CRFIX.SAV (escape)

Then he is prompted to insert the name of the file PCKRA.DAT. The exit from this TECO program is by ↑C. Thereafter RJS is entered with;

@RJS (escape)

IV. THE TECO PROGRAM FOR SIMULATION OUTPUT EDITING

A TECO program is available to select the most important statistics from the output file received at the Network Virtual Terminal from the 360/91. It produces summary statistics and also permits the user to access detailed statistics and to scan through the trace that the simulator on the 360/91 produces. It is called on TENEX by typing;

```
@SIMTECO.SAV;1
```